SB761
U7R6
#84-9
c.1

FOREST PEST MANAGEMENT

BIOLOGICAL EVALUATION R2-84-9

COUNTRY INTEGRATED PEST MANAGEMENT PR

POST-SUPPRESSION EVALUATION

GRAND COUNTY, COLORADO

1984

United States Department of Agriculture

Forest Service

Forest Pest Management
Denver, Colorado

85-12-104

BIOLOGICAL EVALUATION R2-84-9

HIGH COUNTRY INTEGRATED PEST MANAGEMENT PROJECT

POST-SUPPRESSION EVALUATION

GRAND COUNTY, COLORADO

1984

PREPARED BY:

Gene Lessard

GENE LESSARD
Entomologist

REVIEWED AND RECOMMENDED BY:

Robert D Averill

ROBERT D. AVERILL
Group Leader, Entomology

Approved by:

James R Beavers

JAMES R. BEAVERS
Director, Timber, Forest Pest, and
Cooperative Forestry Management

Timber, Forest Pest, and
Cooperative Forestry Management
USDA Forest Service
Rocky Mountain Region
11177 West 8th Avenue
Lakewood, Colorado 80225

LIBRARY
JUN 13 1985
ROCKY MOUNTAIN STATION

HIGH COUNTRY INTEGRATED PEST MANAGEMENT PROJECT

POST-SUPPRESSION EVALUATION

GRAND COUNTY, COLORADO

- 1984 -

INTRODUCTION

In 1983 the basic strategy for the "High Country Integrated Pest Management Project" was formulated by an interagency task force (Averill and Leatherman 1983). The strategy and accepted silviculture prescriptions are displayed in Appendix A and B, respectively. In April 1984, the executive council of the HCIPMP accepted this strategy and issued a statement of purpose and basic strategy[1/]:

1/ Colorado State Forest Service memorandum (April 27, 1984)

HIGH COUNTRY INTEGRATED PEST MANAGEMENT PROJECT STATEMENT

OF PURPOSE AND BASIC STRATEGY

The forest resources of Summit, Eagle and Grand counties are currently under attack by Mountain Pine Beetle (MPB). Beetle epidemics, though not completely understood, are one of nature's processes (along with wildfire) for regenerating mature pine forests. However, human desires are often not compatible with these natural processes. Management, through application of proven and demonstrated techniques, can modify the forest cycle of regeneration, growth, maturity, and death, thus maintaining a level of growth that reduces the potential of catastrophic tree mortality. The forests can be managed to perpetuate the beauty, wildlife, and recreation opportunities, as well as watershed and timber values. The choice is clear. Either man consciously manages the forest or allows "nature" to do so in a helter-skelter fashion.

Mountain pine beetle does not respect property lines or jurisdictional boundaries existing between various government jurisdictions. The Executive Council, representing these various agencies and interests, is integrating management activities toward the common goal of solving the MPB problem in this area under a single project organization, with coordination and direction provided by a Project Manager.

The Council recognizes individual agency policies that limit management actions on particular agency lands. However, it is the intent of the council member agencies to fully support the Statement of Purpose and Basic Strategy within the framework of individual agency policies.

PROJECT GOALS:

1. Minimize adverse impacts of MPB by establishing vigorous insect and disease resistant forests.

2. Maintain, or improve, scenic and recreation qualities.

3. Maintain, or improve, wildlife habitats.

4. Reduce wildfire hazards.

5. Salvage infested and dead lodgepole pine.

ASSUMPTIONS:

1. MPB can be managed to minimize its adverse impacts on the various forest resources.

2. Removal of infested trees through timber sales is the preferred direct control method. Direct control with chemicals is a viable tactic in areas of relatively high value.

3. Prevention of MPB attack with chemicals is feasible on individual high value trees.

4. Prevention of MPB infestation of stands through silvicultural manipulation is feasible where values at risk support that decision.

5. All lodgepole pine stands, regardless of ownership, can be stratified according to risk and value, thus allowing treatment priorities to be set and to guide choice of suitable tactics.

BASIC STRATEGY:

The strategy is to integrate all available management tactics for the host forest type to meet objectives of each of the various agencies and private landowners.

Under current conditions the greatest benefit appears to be from silvicultural treatment of those areas where beetles are not yet present, or are at relatively low levels. However, in areas of high beetle population, reduction of those populations may be required.

Harvest and sale (salvage) of currently infested trees is the preferred method of direct control. Chemical control may also be needed when infested trees cannot be moved before beetle emergence and flight.

There appear to be net benefits from continuing with chemical control efforts in those higher value areas where the beetle is present.

All treatments will be planned and implemented according to joint operating plans drawn up by all agencies. These plans will be made according to a system of stand stratification and prioritization to be developed by an interagency technical task force.

Public recognition of the need for forest management on all ownerships in order to maintain or improve the benefits of these forested lands is a principle goal.

The objectives of this evaluation are:

1. To assess treatment effects on mountain pine beetle populations within designated control areas in Grand County, Colorado.

2. To assess population trends outside designated control areas in Grand County, Colorado.

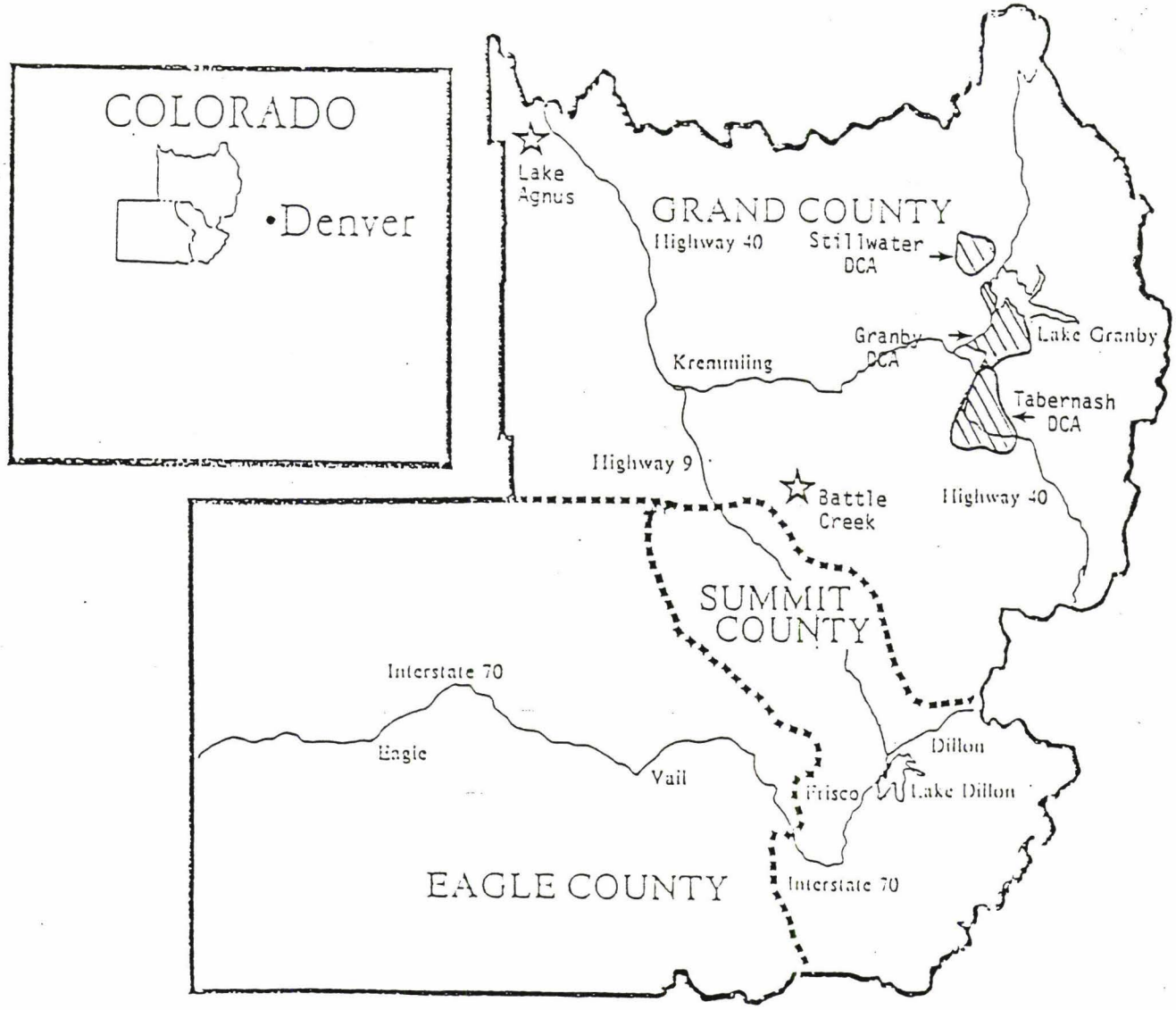
METHODS

Four areas were surveyed in Grand County, Colorado (Figure 1) to estimate the trend and level of mountain pine beetle infestation. In each area stands, cutting units or treatment areas were surveyed using one chain wide strip cruises. The length of the cruise line was determined by the total area to be examined. On each line the diameter of each attacked tree was tallied by year of infestation. Pitchouts were tallied only for 1984 attacks.

Trees per acre attacked was computed for each stand surveyed. The mean trees per acre per stand was used to provide the area estimate. Sample sizes were too small ($n<30$) to calculate standard errors and confidence intervals. Attack ratios were based on the trees per acre estimate for 1984:1983 and 1983:1982. Attack ratios greater than one indicate an increasing infestation trend; and, less than one a decreasing infestation trend.

The Tabernash area was the only area where treatment was accomplished in 1984. Surveys in this area included 10 BAF variable plots located at 10 chain intervals along each cruise line. Stand tables were constructed showing uninfested trees prior to 1982.

FIGURE 1 - LOCATION OF MPB SURVEY AREAS IN GRAND COUNTY, 1984



The following formula was used to calculate percent suppression.

$$\text{Percent Suppression} = \frac{A - B}{A} \times 100$$

where A = trees per acre infested (1984) in the untreated area

B = trees per acre infested (1984) in the treated area

RESULTS

Table 1 displays trees per acre attacked and attack ratios for the 4 survey areas in Grand County, Colorado (1982-1984). Both the trees per acre attacked and the rate of increase from 1983 to 1984 are greater for eastern than western Grand County. Infestations in the Lake Agnus, Battle Creek, and Stillwater areas are in the early stage of outbreak and are expected to continue over the next 3-5 years. Infestations in the Tabernash area are in the late stage of outbreak and are expected to begin declining in 1985 or 1986.

Table 1. Summary of trees per acre attacked and attack ratio by area for Grand County, Colorado (1982-1984).

Area	Trees/Acre Attacked				Attack Ratio	
	1984	1983	1982	Pitch Out	1984:1983	1983:1982
Western Grand Co.						
Lake Agnus	1.2	0.7	0.1	0	1.7:1	7.0:1
Battle Creek	6.1	2.9	2.7	0.7	2.1:1	1.1:1
Eastern Grand Co.						
Stillwater	8.3	2.7	1.6	0.3	3.1:1	1.7:1
Tabernash	45.4	10.6	12.4	2.8	4.3:1	0.8:1

Lake Agnus

Three stands were surveyed in the Lake Agnus area (Table 2). The management prescription (4B) for the area places emphasis on wildlife habitat management for one or more indicator species.

Lodgepole pine stands are seral with climax to spruce-fir. Windthrow in the lodgepole pine component due to shoestring root rot, Armillaria mellea, is heavy. Mountain pine beetle is generally increasing from endemic levels. Lodgepole pine stand susceptibility to MPB ranges from low to high mostly due to the age of the stands. MPB infestations are expected to reach epidemic levels in 3-5 years.

Table 2. Summary of trees per acre attacked and attack ratio for the Lake Agnus area, Grand County, Colorado (1982-1984).

Stand	Trees/Acre Attacked				Attack Ratio	
	1984	1983	1982	Pitch Out	1984:1983	1983:1982
62014-03	0	0	0	0		
42014-04	0.50	1.50	0.25	0	0.3:1	6.0:1
62014-X	3.0	0.67	0	0	4.5:1	
Average	1.2	0.7	0.1		1.7:1	7.0:1

Battle Creek

Seven stands were surveyed in the Battle Creek area (Table 3). The management prescription (4B) for the area places emphasis on wildlife habitat management for one of more indicator species.

Stands are characterized by lodgepole pine and aspen. Though spruce-fir was not encountered during the survey, these species provide the likely climax for the area. Based primarily on average stand diameter, lodgepole pine susceptibility to MPB ranges from low to high.

Table 3. Summary of trees per acre attacked and attack ratio for the Battle Creek Area, Grand County, Colorado (1982-1984).

	Trees/Acre Attacked				Attack Ratio	
Stand	1984	1983	1982	Pitch Out	1984:1983	1983:1982
63301-09	0	0	0.25	0		
-10	4.30	0	3.33	0		
-12	0	0	.32	0		
-15	0	0	0	0		
63302-03	2.08	2.36	1.53	0.14	0.9:1	1.5:1
-04	11.50	4.50	10.50	1.00	2.5:1	0.4:1
63303-03	24.48	13.45	3.10	4.14	1.8:1	4.3:1
Average	6.1	2.9	2.7	0.7	2.1:1	1.1:1

In stands sampled in compartment 63301 and compartment 63302 stand 03, MPB infestations are static at relatively low levels. Populations are not expected to increase to outbreak levels due to the high proportion of small diameter lodgepole in these stands.

In compartment 63302 stand 04 and compartment 63303 stand 03, MPB infestation is epidemic. This epidemic is expected to continue to increase over the next 2 to 3 years.

Stillwater Creek

Five proposed cutting units were sampled in the Stillwater area (Table 4). Unit 19 was marked with a leave-tree mark and an unnumbered unit was marked with a cut-tree mark. Units 13, 14, and 20 were unmarked. All 5 proposed cutting units fell within management prescription 2B. This prescription places emphasis on dispersed recreation for roaded and rural recreation opportunities.

Table 4. Summary of trees per acre attacked and attack ratio for the Stillwater area, Grand County, Colorado (1982-1984).

	Trees/Acre Attacked				Attack Ratio	
Cut Unit	1984	1983	1982	Pitch Out	1984:1983	1983:1982
13	10.69	7.41	1.03	0.17	1.4:1	7.2:1
14	20.58	2.31	5.38	0.77	8.9:1	0.4:1
19	1.22	0.67	0.55	0	1.8:1	1.2:1
20	2.50	1.00	0.75	0.11	2.5:1	1.3:1
Cut-tree	6.77	2.00	0.46	0.46	3.4:1	4.3:1
Average	8.3	2.7	1.6	0.3	3.1:1	1.7:1

Old growth lodgepole pine was a significant component of the sampled units indicating that this species is probably climax over most of the area. Stands in the survey area are moderately to highly susceptible to MPB. Infestations in units 13 and 14 are epidemic. This epidemic is expected to continue for the next 2 to 3 years. Infestations in units 19, 20 and "cut-tree" are increasing and should reach epidemic levels by 1986.

Table 5 displays trees per acre attacked by year and whether "leave-tree" or "cut-tree" for the two marked units. In unit 19 about 20% of the 1984 infested trees are leave trees. In the cut-tree unit about 60% of the 1984 infested trees are leave trees; and, about 15% of the 1983 infested trees are leave trees.

Table 5. Summary of trees per acre by cut- and leave-tree for units 19 and cut-tree mark, Stillwater area, Grand County, Colorado (1982-1984).

	Trees/Acre Attacked					
	1984		1983		1982	
Unit	Leave Tree	Cut Tree	Leave Tree	Cut Tree	Leave Tree	Cut Tree
19	0.22	1.00	0	0.67	0	0.55
cut-tree	4.00	2.77	0.31	1.69	0	0.46

Tabernash

Two untreated stands (Table 6) and 6 treated units (Table 7) were surveyed in the Tabernash area. Ownership in the area consists of a mix of BLM and private lands.

Infestations in the area are epidemic and should begin declining in 1986 or 1987. An average of about 45 trees per acre are currently infested.

Of the 6 treatments, 4 were direct control through salvage logging of infested trees and 2 were 8-inch diameter limit cuts plus salvage logging of infested trees (Table 7).

Salvage Logging - Direct control through salvage logging infested trees occurred on about 160 acres. This represents about 1% of the total acres in the Tabernash DCA. The percent suppression within the treated areas ranged from 77.3 (Silver Creek) to 96.1 (Eitemill)[1/]. The average percent suppression was 88.3.

Table 6. Summary of trees per acre attacked and attack ratio for the Tabernash area, Grand County, Colorado (1982-1984).

	Trees/Acre Attacked				Attack Ratio	
Stand	1984	1983	1982	Pitch Out	1984:1983	1983:1982
Silver Creek 15	32.80	7.20	2.40	1.20	4.5:1	3.0:1
Silver Creek 8	58.00	14.00	22.50	4.50	4.1:1	0.6:1
Average	45.4	10.6	12.40	2.8	4.3:1	0.8:1

Table 7. Summary of trees per acre attacked by treatment for the Tabernash area, Grand County, Colorado (1982-1984).

Salvage (Direct Control)

		Trees/Acre Attacked				
Unit	Acres[2/]	1984	1983	1982	Pitch Out	Percent Suppression[3/]
BLM	40	2.76	0.34	1.03	0.34	93.9
Eitemill	40	1.75	0.25	0	0.25	96.1
Chenowith	40	6.25	0	0	1.50	86.2
Silver Creek	40	10.29	0	8.82	0.32	77.3
Average		5.3	0.1	2.5	0.60	88.3

1/ Colorado State Forest Service memorandum (April 27, 1984) sets effectiveness of suppression at 80% of the land base treated with 95% efficacy.

2/ Estimated acres treated

3/ Abbots formula

8-inch diameter limit cut

Unit	Acres[1]	Trees/Acre Attacked 1984	1983	1982	Pitch Out	Percent Suppression[2]
A	20	4.58	2.50	0.42	1.25	89.9
B	20	9.50	1.00	1.00	0.50	79.1
Average		7.0	1.8	0.7	0.9	84.6

8-inch diameter limit cuts - 8-inch diameter limit cuts occurred on about 40 acres. This represents about 0.25% of the Tabernash DCA. Percent suppression ranged from 79.1 on unit B to 89.9 on unit A. The average percent suppression was 84.6.

For all treatments average percent suppression is 87.1 within the 200 acres treated. Within the Tabernash DCA suppression in 1984 is negligible (1.25% x 87.1% = 1.1%).

Mountain pine beetle caused tree mortality in the 8-inch diameter limit cuts is expected and consistent with the findings of Cole, et al (1983) (Table 8). As the leave tree diameter increases mountain pine beetle caused mortality increases. The decrease in the 12-inch diameter limit cut was due to a higher proportion of infested trees being removed than in the 7- and 10-inch cuts. The expected annual mortality in the 8-inch diameter cuts is about 2.5 trees per acre (extrapolated from Cole et al 1983). Cole et al (1983) noted that "The best deterrent of recurring infestation - amount of losses and length of time - was the 100-leave-tree cut."

Table 8. Comparison of mountain pine beetle caused lodgepole pine mortality with treatment.

Treatment	MPB Caused Mortality - Trees/Acre -	Source
7-inch cut	1.32	Cole et al 1983
8-inch cut	7.04	Tabernash DCA
10-inch cut	11.08	Cole et al 1983
12-inch cut	6.34	Cole et al 1983
100-leave tree cut	0.30	Cole et al 1983

1/ Estimated acres treated

2/ Abbots formula

RECOMMENDATIONS

The primary deterrent to the success of the "High Country Integrated Pest Management Project" in Grand County has been the lack of a site specific joint operating plan. This plan was mandated by the Executive Committee[1/]: "All treatments will be planned and implemented according to joint operating plans drawn up by all Agencies. These plans will be made according to a system of stand stratification and prioritization to be developed by an interagency technical task force." The approach to stand stratification and prioritization has been developed and is presented in Appendix A. This approach is designed to match management strategy to a land classification system. Five major premises were developed in this approach. These premises bear repeating as failure to recognize them will lead to failure for the project:

1. All host type, regardless of ownership can be stratified into land classification units.

2. Mountain pine beetle cannot be controlled by any method over extensive areas of land.

3. Management and control of mountain pine beetle is viable in restricted areas of type having relatively high value.

4. The ideal strategy for managing mountain pine beetle is to intensively manage the host type, thereby preventing outbreaks from occurring.

5. Prevention is a viable strategy only in moderate to high susceptible stands or in low susceptible stands which will be in a moderate to high susceptible condition in the near future.

Specific recommendations for the HCIPMP in Grand County are:

1. To develop and implement a site specific joint operating plan in accordance with the approach outlined in Appendix A. This plan should be accepted and approved by the Executive Committee.

2. To cease control efforts in the Tabernash DCA. This population should be allowed to run its course. Preventive sprays should be used to protect higher value trees.

3. Accelerate harvesting of lodgepole pine in the Stillwater and Grand Lake DCA's. A list of recommended prescriptions is given in Appendix B. Mountain pine beetle control should be associated with areas currently under timber sale contract. Preventive sprays should be used to protect high value trees.

1/ Colorado State Forest Service memorandum (April 27, 1984)

4. Discontinue diameter limit cutting where natural regeneration is inadequate to provide future stocking (see prescriptions 3 and 4 in Appendix B).

5. Where diameter limiting cutting has been in use, primarily in the Stillwater DCA, thin residual dense pockets of lodgepole pine to growing stock level 80.

APPENDIX A

A Revised Strategy

Mountain pine beetle (Dendroctonus ponderosae Hopk.) is endemic to lodgepole pine (Pinus cortorta Dougl.), ponderosa pine (P. ponderosa Laws.) and limber pine (P. flexilis James) in Colorado. Tree mortality caused by this insect will continue to occur where there are suitable host tree speices. The key to managing the insect-host complex is to reduce tree mortality to some acceptable level. An acceptable level of tree mortality will vary in accordance with the goals and objectives of the land manager for specific land areas. Therefore, management strategies must be developed which consider a wide range of management objectives and land use values.

Using decision analysis, a procedure was developed to match management strategy to a land classification system (Freeling and Seaver, 1980). The procedure first develops a land classification system based on the following criteria:

1. Risk to mountain pine beetle (MPB) infestation
2. Land accessibility (and/or operability)
3. Tree value

The eight land classification categories developed were:

A. Moderate to high MPB risk
   Accessible
   High individual tree value

B. Moderate to high MPB risk
   Accessible
   Low individual tree value

C. Moderate to high MPB risk
   Inaccessible
   High individual tree value

D. Moderate to high MPB risk
   Inaccessible
   Low individual tree value

E. Low risk to MPB
   Accessible
   High individual tree value

F. Low risk to MPB
   Accessible
   Low individual tree value

G. Low risk to MPB
Inaccessible
High individual tree value

H. Low risk to MPB
Inaccessible
Low individual tree value

The criteria used to develop the land classification system are qualitative. However, each can be quantified. Since this is a dynamic classification scheme, it will need to be updated to keep pace with tree growth (risk), improved harvesting technology, and changing land use values.

Mountain pine beetle risk - There are three published schemes for risk rating mountain pine beetle in lodgepole pine (Amman et al. 1977; Waring and Pitman 1980; Schenk et al 1980). To date Amman et al (1977) is the most reliable scheme to estimate stand risk to mountain pine beetle. In addition this scheme is available on computer using Stage II data.

Accessibility - Accessibility implies operability. Both accessibility and operability vary with the management strategy selected and the equipment available to implement the strategy. As an example, slopes in excess of 40% may be inoperable to conventional logging equipment but operable for a high lead system; or, operable for chemical pesticide application.

Tree Value - Value systems are highly variable and often difficult to quantify. The goals and objectives established for an area determine the value system(s) to be used (ie, recreation and aesthetics, wildlife habitat, wood fiber, etc.). Thus, a given piece of land and tree resource will have a value affected by tree density, and quality, and land use. Effects of the mountain pine beetle may enhance or detract from that value. The objective is to minimize the loss of the resource value from mountain pine beetle through the application of one or more strategies. For mountain pine beetle there are three preventative strategies:

1. Thinning of stands

2. Preventative spraying

3. Favoring tree species other than the host species

and one suppression strategy:

1. Direct control-actions taken to reduce the population immediately.

Inherent in these management strategies is their applicability, or more properly, their nonapplicability on some land classifications. As an example, direct chemical treatment of low risk, low value trees over large

inaccessible areas would be inefficient economically and therefore inappropriate.

Five major premises were developed using decision analysis (Freeling and Seaver, 1980):

1. All host type, regardless of ownership can be stratified into land classification units.

2. Mountain pine beetle cannot be controlled by any method over extensive areas of land.

3. Management and control of MPB is viable in restricted areas of type having relatively high value.

4. The ideal strategy for managing mountain pine beetle is to intensively manage the host type, thereby preventing outbreaks from occurring.

5. Prevention is a viable strategy only in moderate to high susceptible stands or in low susceptible stands which will be in a moderate to high susceptible condition in the near future.

Failure to recognize these premises will lead to failure for any long range management of mountain pine beetle.

Management opportunities identified in the decision analysis process (Freeling and Seaver 1980) were:

1. Incorporate into Forest plans management prescriptions for the major insects and diseases causing tree damage in the Region.

2. Involve State and local governments to a greater degree in future planning efforts.

3. In cooperation with Federal, state and local governments and private landowners implement a management program to prevent and suppress the mountain pine beetle on all lands in land classifications A, B, C, and E using the following recommended strategies.

Land Classification A - On developed recreation areas where mountain pine beetle is present, the preferred strategy is to suprpess the insect by harvesting infested trees before beetle flight. On developed recreation areas where an epidemic has run its course, the preferred strategy is to do nothing. If an epidemic has not yet occurred, thinning is recommended. This reduces the susceptibility of the area to mountain pine beetle.

On type A areas other than developed recreation sites, the preferred suppression strategy is thinning for prevention, or harvesting of infested trees. In areas where the beetle is already epidemic, the preferred strategy is dependent upon tree value and recreation values. If the recreational value is greater than about six times the stumpage value (acre basis), then suppression is best. With lower recreation values, however, thinning is the preferred strategy. In areas where the beetle is either not present, or inactive, thinning is preferred, as thinning may prevent beetle epidemics. In particular, immediate thinning is much preferred to waiting for an epidemic to start and then thin. Thorough analysis of the benefits and costs of the various tactics in relation to the value of the management objectives will aid in development of the preferred approach to suppression in a given situation.

Land Classification B - In these areas a thinning program is the preferred strategy. This is due largely to the beneficial silvicultural effects and reduce detrimental recreation effects.

Land Classification C - In these areas where thinning is impractical due to contstraints on accessibility and operability, suppression by chemical means is considered the best strategy under epdiemic conditions. However, this stragey is only marginally superior to doing nothing and accepting the losses.

Land Classification E - On these low MPB susceptibility areas, harvesting infested trees is the preferred strategy. Because these are high value lands, this strategy is effective in reducing the impacts on scenic, recreational and real-estate value.

In summary, the greatest benefit appears to be from thinning programs in those highly susceptible areas where beetles are not present, but there is also some net benefit from continuing with suppression efforts in those higher value areas where beetles are present.

4. On land classification areas D, F, G, and H allow the mountain pine beetle to run its course.

5. Initiate and maintain a continuous program of unified management on all lands.

APPENDIX B

The prescriptions presented here are a result of an interagency task force composed of entomologists, silviculturists, pathologists, and foresters from the CSFS and USDAFS. These prescriptions were developed in 1981 and have been applied to several locations in Summit, Colorado.

GENERAL PRESCRIPTION

The purpose of the general prescription is to describe the ecological situation in which epidemic outbreaks of mountain pine beetle are least likely to occur and to provide a guiding framework for the more specific stand prescriptions. The following objectives are included in the general prescription:

1. Establish a diverse mosaic of stand size classes, age classes, and species mixtures.

2. Design this mosaic for an aesthetically pleasing appearance and for productive wildlife habitat conditions.

3. Make a long term commitment for management to avoid stand conditions susceptible to epidemic outbreaks. This can partially be accomplished through Forest Plans.

4. Provide access needed for stand management, now and in the future.

5. Salvage felled or killed trees to the extent possible.

6. Maintain and improve visual quality through varying stand shapes and sizes, removing of visually dominant dead trees, and increasing species diversity of the vegetation.

7. Replace susceptible lodgepole pine in recreation or high use areas through planting of species appropriate to site conditions. This may include planting of lodgepole pine, other conifers, leaving created openings, or planting species beneficial to wildlife and aesthetics.

8. Develop specific long term vegetation management plans for ski areas or other high-value developed sties.

9. Prioritize stands for treatment using the risk ratings shown in "Guidelines for Reducing Losses of Lodgepole Pine to the Mountain Pine Beetle in Unmanaged Stands in the Rocky Mountains" by Amman, McGregor, Cahill and Klein, 1977, USDA Forest Service, Gen. Tech. Rpt. INT-36, Intermountain For. and Rng. Expt. Stn., Ogden, UT.

10. Insects in currently infested trees may be directly controlled using chemical, mechanical, or burning methods in combination with silvicultural methods.

11. Reduce existing and resultant highly hazardous fuel accumulations.

12. Re-examine stands for effectiveness of treatment methods within 5 years of accomplishment.

The following prescriptions were developed for stand conditions anticipated with the project area. These prescriptions are qualified by the fact that not all conditions can be anticipated and owner objectives for specific locations may preclude application of the recommended treatments. Nevertheless, the prescriptions are judged to have the best potential for containing the present outbreak of mountain pine beetle.

Figure 1

PRESCRIPTION NUBMERS FOR MAJOR CONDITIONS AND SITUATIONS ANTICIPATED IN PROJECT AREA

Stand Condition	Forest Situation		
	Undeveloped Forest*	Developed Forest*	Wilderness
Susceptible LPP (7" d.b.h. +)			
Without manageable understory	1	2	11
With manageable understory	3	4	11
At least 10% BA other species	5	6	11
Stagnated, Immature LPP	7	7	11
Immature LPP Responsive to Thinning			
(less than 70 years old, pointed crowns, 40%+ live crown)			
Pure lodgepole	8	8	11
At least 10% BA other species	9	9	11
Other Species			
Less than 30% LPP	10	10	11

* Undeveloped forest is land where recreation and amenity values do not greatly exceed those of other resources. Developed forest is land where recreation values are very high and includes campgrounds, roadside zones, ski areas, private lands held for recreation purposes, or other developed sites.

Prescription No. 1

Susceptible Lodgepole Pine Without Understory - Undeveloped Forest

1. Cutting Methods:
   A. Clearcut stands up to 40 acres to size
   B. Patch cut within stands with cut units up to 10 acres in size

All basal area of lodgepole pine would be removed in both treatments.

2. Slash Disposal and Site Preparation Methods:
   A. Lop and scatter slash
   B. Salvage for firewood

3. Regeneration Methods:
   Natural regeneration

4. TSI Methods;
   Not applicable

5. Other Treatments:
   A. Salvage any uncut areas within stands
   B. Fell unmerchantable trees infected with dwarf mistletoe

6. Constraints:
   Size of adjacent areas not clearcut should be approximately equal or larger in size to clearcut areas. Shapes will be influenced by appearance of the openings from important vantage points.

Prescription No. 2

Susceptible Lodgepole Pine Without Understory - Developed Forest

1. Cutting Methods:
   A. Patch cut within stands
   B. Shelterwood seed cut to basal area of 60 or less
   C. Thin from above removing most susceptible trees first to an approximate growing stock level of 80
   D. Thin from below to an approximate growing stock level of 80

2. Slash Disposal and Site Preparation methods:
   A. Pile and burn
   B. Physical removal
   C. Lop and scatter
   D. Salvage for firewood

3. Regenerating Methods:
   A. Natural regeneration
   B. Plant species best suited to site

4. TSI Methods:
   Fell unmerchantable lodgepole in thinning treatments as needed to meet growing stock level objective.

5. Other Treatments:
   Preventative treatments with chemicals.

6. Constraints:
   A. Size of patch cuts to be constrained by location, appearance, and owner objectives.
   B. Partial cuts constrained by windthrow susceptibility, dwarf mistletoe infection level, owner objective, or other on-site condition.

Prescription No. 3

Susceptible Lodgepole Pine With Manageable Understory - Undeveloped Forest

1. Cutting Methods:
   A. Removal cut taking all lodgpeole pine in excess of 7 inches d.b.h.
   B. Removal cut in stages, taking the most susceptible lodgepole pine in the first cut

2. Slash Disposal and Site Preparation Methods:
   A. Lop and scatter
   B. Salvage for firewood

3. Regeneration methods;
   Not applicable

4. TSI Methods;
   A. Thin understory if needed
   B. Remove mistletoe infected lodgepole in understory

5. Other Treatments:
   None

6. Constraints:
   Size and shape of opening may be constrained as in clearcutting if understory is not of sufficient size to have visual significance.

Prescription No. 4

Susceptible Lodgepole Pine with Understory - Developed forest

1. Cutting Methods:
   A. Removal cut in stages removing the most susceptible lodgepole pine in the first cut
   B. Removal cut in one cut in patches up to 10 acres.

2. Slash Disposal and Site Preparation Methods:
   A. Pile and burn
   B. Physical removal
   C. Lop and scatter
   D. Salvage for firewood

3. Regeneration Methods:
   Not applicable

4. TSI Methods;
   A. Thin undrstory if needed
   b. Remove mistletoe infected lodgepole in understory

5. Other Treatments;
   Preventative spray

6. Constraints:
   Size and shape of opening in one cut removals will be determined by owner objective and visual impact.

Prescription No. 5

Susceptible Lodgepole Pine with Mixture of Other Species - Undeveloped Forest

1. Cutting Methods:
   A. Shelterwood seed cut to basal area of 60 or less, retaining mixed species for seed and shelter
   B. Improvement - salvage cut removing the most susceptible lodgepole and worst individuals of mixed species
   C. If mixed with aspen, patch cut lodgepole around the spen. Aspen may or may not be cut depending on situation. Remove lodgepole pine from aspen patches.

2. Slash Disposal and Site Preparation Methods:
   A. Lop and scatter
   B. Salvage for firewood

3. Regeneration Methods:
   Natural regeneration

4. TSI Methods:
   Weed and release felling to favor the mixed species

5. Other Treatments;
   None identified

6. Constraints:
   None indentified

Prescription No. 6

Susceptible Lodgepole Pine with Mixture of Other Species - Developed Forest

1. Cutting Methods:
   A. Improvement - salvage cut removing the most susceptible lodgepole pine and worst individuals of mixed species
   B. Shelterwood seed cut to basal area of 60 or less, retaining mixed species for seed and shelter
   C. Partial or patch cut to favor aspen only outside of campgrounds or other areas with heavy foot traffic

2. Slash Disposal and Site Preparation Methods:
   A. Pile and burn
   B. Physical removal
   C. Lop and scatter
   D. Salvage for firewood

3. Regeneration methods:
   A. Natural regeneration
   B. Plant species appropriate to site conditions, favor those other than lodgepole

4. TSI Methods:
   Weed and release felling to favor the mixed species

5. Other Treatments:
   Preventative Spray

6. Constraints:
   Site specific depending on location

Prescription No. 7

Stagnated Immature, Nonsusceptible - Undeveloped and Developed Forest (Judged not capable of release, generally more than 70 years old, rounded or tufted tops, less than 40% live crown, or DMR rating of 3.0 or more)

1. Cutting Methods:
   Defer treatment

2. Slash Disposal and Site Preparation Methods:
   Defer treatment

3. Regeneration methods:
   Defer treatment

4. TSI Methods:
   Defer treatment

5. Other Treatments:
   None identified

6. Constraints:
   None identified

Prescription No. 8

Immature, Responsive Lodgepole Pine - Undeveloped and Developed Forest

1. Cutting Methods:
   A. Precommercial thinning between August and March to a growing stock level of 110 or less
   b. Defer treatment

2. Slash Disposal and Site Preparation methods:
   A. Lop and scatter
   B. Salvage for firewood
   C. Pile and burn
   D. Chipping

3. Regeneration Methods;
   Not applicable

4. TSI Methods:
   A. Thin by felling
   B. Sanitize by felling mistletoe infected lodgepole

5. Other Treatments:
   None identified

6. Constraints: Site specific, depending on location.

Prescription No. 9

Immature, Responsive Lodgepole with 10% or More Other Species - Undeveloped and Developed Forest Sites

1. Cutting Methods:
   A. Precommerical thinning between August and March to a growing stock level of 110 or less. Favor other species to the extent possible.
   B. Defer treatment

2. Slash Disposal and Site Preparation Methods:
   A. Lop and scatter
   B. Salvage for firewood
   C. Pile and burn
   D. Chipping

3. Regeneration Methods:
   Not applicable

4. TSI Methods:
   Not applicable

5. Other Treatments:
   Preventative chemical spray on developed Forest sites

6. Constraints:
   None identified

Prescription No. 11

All Stand Conditions - Wilderness

Method:
Prepare a biological assessment of potential for outbreak and possible treatment alternatives.

Slash Disposal and Site Preparation Methods:
Not applicable

Regeneration Methods:
Not applicable

TSI Methods:
Not applicable

Other Treatments:
None identified pending results of biological assessment

Constraints:
Associated with Wilderness Act

LITERATURE CITED

Averill, R. D. and Dave Leatherman. 1983. Mountain pine beetle in Grand County, Colorado - 1983. USDA For. Serv. Bio. Eval. R2-83-6. 7 pp.

Cole, Walter E., Donn B. Cahill, and Gene Lessard. 1983. Harvesting strategies for management of mountain pine beetle infestations in lodgepole pine. Preliminary evaluation, East Long Creek Demonstration Area, Shoshone National Forest, Wyoming. USDA For. sErv. Res. Note INT-333. 11 pp.